Available online at www.sciencedirect.com
ScienceDirect
Renewable and Sustainable Energy Reviews
11 (2007) 1188–1207
RENEWABLE & SUSTAINABLE ENERGY REVIEWS
www.elsevier.com/locate/rser

Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'

Maarten Wolsink*

Received 13 October 2005; accepted 13 October 2005

Abstract

Public attitudes anywhere in Europe show moderate to strong support for the implementation of renewable energy. Nevertheless, planning wind power developments appears to be a complicated matter in most countries. The problems that have to be dealt with during decision making processes on the siting of wind turbines are usually referred to as mere 'communication problems'. However, public attitudes towards wind power are fundamentally different from attitudes towards wind farms. This 'gap' causes misunderstandings about the nature of public support for renewables. In particular where planners easily assume support for renewables can be generated by information campaigns emphasising the environmental benefits, whereas opposition to renewable energy schemes can be explained by a selfish 'not in my backyard' attitude. Both explanations used by planners, authorities and, unfortunately, by many scholars, are falsified. Furthermore, policies that still take this 'common knowledge' for granted can have negative consequences for the implementation rates of renewables. Visual evaluation of the impact of wind power on landscape values is by far the dominant factor in explaining why some are opposed to wind power and others are supporting it. Moreover, feelings about equity and fairness appear the determinants of 'backyard' motives, instead of selfishness.

Keywords: Attitudes; Wind power; Facility siting; Landscape; Nimby scale; Fairness

*Tel.: +31 20 525 6229; fax: +31 20 525 4051.
E-mail address: M.P.Wolsink@uva.nl.

1364-0321/$ - see front matter
doi:10.1016/j.rser.2005.10.005

Contents

1. Introduction

Climate policies present the transformation to sustainable energy provision, particularly the application of renewable sources, as the key to CO_2 reduction. The development of renewables has, however, proven to be an uphill battle. The technical aspects of biomass, thermal solar and, particularly, solar photovoltaic (PV) still need to be developed in much more detail, and their application is still heavily dependant on subsidies and demonstration schemes. Wind power has vastly improved from a technical point of view and has been successfully implemented in a number of countries (Germany, Denmark, Spain). However, capacity is only being developed very slowly in most countries (Sweden, Greece, Italy, France), and some have even failed to meet the development targets that were officially proposed (The Netherlands and—in spite of its enormous potential—the UK). In the Netherlands, e.g., the official policy target from 1985 until 2000 was 1000 MW installed capacity. However, only a little more than 400 MW has been realised, due to three significant institutional factors [1]:

- An early national policy choice for energy utilities as the prime investors and for large-scale application.
- Entanglement with other policy objectives.
- A financial procurement system based primarily on capital investment instead of energy yield which has been frequently changed and which, as a result of that instability, is regarded as unreliable by investors.
- A neglecting of the importance of creating sites for wind power developments.

Although all renewables have specific characteristics, and these factors consequently manifest themselves in different ways, it is likely that they will be applicable for sources of energy other than wind. Recently, in the UK, progress on the implementation of biomass has been disappointing for similar reasons [2]. The first three factors are central planning problems, and several of the objectives have a detrimental effect on the goal of renewable energy application. Policy often tends to treat other objectives (regional development,

industrial development, trade, etc.) as equal or as superior to the objectives of climate change and energy diversity. Shaping policy on the basis of the objective of developing a turbine industry before the creation of a home market has been the problem facing the development of wind power in The Netherlands [3,4]. Furthermore, the choice of policy instruments focuses primarily on economic incentives, but these are always directed at typical market actors. The question is, whether these actors do really matter for the development of new technology and its real-life application. Most of the typically proposed and applied criteria catalogues still ignore the interests and requirements of important stakeholder groups [5]. Hence, in practice, the fourth factor, viz. the creation of demand for wind turbines by developing sites, has become the most significant one.

The main problems related to successful siting policy concern spatial planning and public acceptance. However, these issues are, in turn, related to a fundamental characteristic that the first three factors have in common. This is the idea that, at the central (national) level, it is possible to determine the exact dimensions of individual wind power schemes. This is a tragic mistake to make. The fact that the policy option for subsidies in capital investment was based on the generating capacity of wind turbines is a Dutch example of this misunderstanding. The result was that Dutch manufacturers artificially boosted the kW rating of their turbines to maximize subsidies [3]. Eventually, these machines could not compete on the international market. Making space for wind farms also relied on top–down planning. Given that site development has to do with spatial development policy and public acceptance, this paper analyses the impact of the centralised policy model on public attitudes.

2. Identification of the problem

Studies on public attitudes anywhere in Europe show moderate to strong support for the implementation of wind power. Nevertheless, planning wind power development appears to be a complicated matter in most countries. Studies on wind power attitudes, which started in the 1980s, have demonstrated general public support—in the US [6], The Netherlands [7,8] and the UK [9]. Ever since, surveys have shown similar general support patterns, including recent studies in countries like Greece and Sweden, which started developing wind power only recently [10,11]. Nevertheless, within the centralised model, the advocates of wind power development still end up being confronted by local opposition to their schemes . Hence, the key question to be answered in this paper is:

- What exactly are public attitudes towards wind power?
- What is the role of local environmental conditions in shaping public attitudes?
- What conditions might improve public acceptance, and to what extent are environmental conditions crucial to those conditions?

The success of national environmental policies on the implementation of renewable energy ultimately depends on the number of successful projects in which renewable sources are applied. Successful investments and the siting of wind power plants eventually determine the success rate of national efforts in establishing renewable capacity. Moreover, the current problems facing wind power are similar to those that originally faced other renewable power plants, notably biomass [12,13]. Although PV has hardly reached a stage at which feasible implementation is possible, the first signs are still that public acceptability

of siting decisions is going to play a similarly significant role [14]. Hence, if we examine the role of public acceptance, the key question is not whether national environmental policies directed at renewables are accepted, but rather whether individual renewable energy schemes themselves are accepted. We must examine the attitudes to actual decisions on investments and on selecting locations for the construction of renewable power plants. We therefore have to examine the level at which these decisions are actually taken, viz. at local level. The problems that have to be dealt with during decision making processes on the siting of wind turbines are usually referred to (by planners and decision-makers) as mere 'communication problems'. All the research on public perceptions, on planning wind power schemes and on the lack of success as regards implementation in some countries, indicates that poor communication may indeed play a role. However, the only interesting strategic issue is *why* poor communication is prevalent.

3. Methods

3.1. Nature of public attitudes

First of all, communication *always* misses its targets when it does not address the real concerns of the people to whom the message is directed. These concerns are determined to a great extent by local environmental conditions, as confirmed by studies of public attitudes. Policy and researchers present renewables as a solution to environmental problems, particularly of the global issues linked to fossil fuel and nuclear power. Even after careful siting and design, the fact that 'there may be some local environmental disruption, must be set clearly against the much larger global benefits from the deployment of renewables' ([15], p. 272). It is precisely this dilemma that is shaping the stalemate that often occurs when renewables are implemented. The proponents argue about global warming, but this is nothing more than a distant background argument in the context of local decisions being taken on actual renewables projects.

Attitudes towards wind power are fundamentally different from attitudes towards wind farms, and this distinction is at the heart of most public attitude misunderstandings. These misunderstandings as regards the nature of attitudes are strongly reinforced by the poor methodology that is usually applied when public surveys on renewables are carried out. Most are one-off case studies carried out on one wind development location, while others are general public surveys. The character of these is usually ad-hoc with questionnaires that do not apply clear conceptual frameworks, such as social psychology theories on attitude formation. This often results in eclectic conclusions with very limited possibilities for identifying general trends. A review on attitude research on wind power draws the following conclusion:

> 'Despite a plethora of empirical studies, there is a lack of valid and reliable quantitative methodological tools for operationalizing public perceptions of wind farms. With a few notable exceptions probabilistic multivariate statistical tools have not been used to explain variance in reaction to and support for wind energy development' [16, p. 135].

The significance of this observation can be illustrated by a comparison of simple, one-dimensional analysis of survey data with more multivariate analysis of the same data. It will not only show why more sophisticated data and methods of analysis are needed, but

will also provide important conclusions about the nature of public attitudes towards renewables and the relevance of environmental issues.

The research that is presented here is a secondary and extended analysis of existing data gathered on several occasions at many different places. The data was gathered between 1986 and 2002 in comparative studies (similar surveys on locations with distinguished conditions concerning wind power), impact studies (pre-test, post-test studies) and geographically defined (countries, locations) or sociologically defined (i.e. environmental organisation members) cross-section surveys. Furthermore, results are underpinned by research on similar siting processes relating to waste facilities, in order to elaborate the important 'not-in my back yard' bias that hampers the vision of planners, investors and policy makers. All the data concern large-scale structured surveys that offer the option of reliability checks (scale analysis, principal components analysis) and statistical multivariate analysis (covariance analysis, regression analysis).

3.2. Perceptions on the relevance of environmental aspects

First we summarise the conclusions on general attitudes on wind power without going into detail. Attitudes of the public as such are not the issue, because on the average general attitudes towards wind power are very positive [8,9,16,17]. The fact that a minority does not support wind power is not surprising because there is hardly anything in life that is universally supported. The existence of opponents is merely a fact of life and, furthermore, it may be rooted in fundamental arguments concerning landscape characteristics and community identity [18,19]. Actually, the support is remarkably high. Our first focus is on the significance of wind power aspects, as perceived by the public itself.

Table 1 presents results that are similar to the methods usually applied in most (ad-hoc) wind power surveys. The figures clearly seem to indicate that the environmental value of clean, renewable energy is the most important determining factor in the attitude towards wind power. When the aspects are presented to the public, by means of the following question: 'From the presented list of 20 possible consequences of the application of wind power presented, can you please mark all those you consider significant? the ranking of aspects, as presented in Table 1, is generated. Table 1 also shows the results of a similar question. This time, however, the question referred to an assessment of the importance of each of the categories of consequences of wind power application presented. The figures

Table 1
Significance as perceived by the public I

	Mean	Rank
Decreasing environmental issues	6.23	1
Annoyance issues	4.95	3
Nature, landscape values	4.61	4
Electricity prices	4.61	5
Large numbers in landscape, scenic impact	4.45	2
Impact on power sector	3.93	6

Question about importance of issues for wind power (mean 7-*p* scales), and issues mentioned in open question (ranks).
$N = 725$; sample data [17].

Table 2
Significance as perceived by public II

Visual: (scenic evaluation)	0.48	$p < .001$
Decrease environmental issues	0.19	$p < .001$
Annoyance	0.17	$p < .01$
Electricity sector	0.07	$p < .05$
Elements of interference	0.01	n.s.

Covariance analysis (linear regression) to explain variance: impact of attribute scales on wind power attitude. Same sample as Table 1; β-weights.
$N = 725$; sample data [17].

come from the same sample, and the categories are based on the component analysis of the full list of 20 different attributed aspects of wind power application [7,8].

These figures from both questions seem to support the ideas of wind power investors and planners, viz. that the public will support their schemes because of the general environmental benefits. However, this conclusion is based on an incorrect interpretation of the significance of issues as regards the formation of attitudes. The open question already indicates that the scenic impact may be more important than the average assessment of importance is suggesting. The figures are averages, and are also determined by people who are inclined to assign a low rate to an aspect. The variance of the landscape and scenic aspects of wind power is greater than for the other categories, indicating that this is the aspect about which there is most disagreement. This is very significant, as can be seen in Table 2.

Clearly, the fact that most people mention the environmental aspect of application of this renewable source is important. It is the basis for the strong general support. Nevertheless, the support is still an average, and does not tell us anything about the differences in the varying range of attitudes towards wind power. When it comes to explaining the differences, the ideas about the clean character of wind power are not very helpful. If we try to explain why there are differences in support, we need to generate a co-variance analysis. Table 2 shows data on such an analysis (regression) using exactly the same sample as in Table 1, that is several multi-item scales based on a combination of beliefs about attributes (e.g. ‘wind power will cause a lot of bird casualties”—five-point scales from ‘I do not expect that at all’ to ‘that is very likely’) and evaluations of such attributes (e.g. five-point scales ‘I consider many turbines in the landscape very negative—very positive) [8,17].

Because of the high average score as regards ‘decrease of environmental issues’, policy makers and proponents of wind power usually assume that improving knowledge among the public will enhance positive attitudes. However, although there is nothing wrong with the idea to improve public knowledge about renewables, this will not simply change attitudes. Generally, studies show that there is hardly any relation between the level of knowledge and attitudes [20]. Knowledge about wind power (index of correct answers on seven questions) is not associated with attitudes in the study presented in Tables 1 and 2 ($r = -.04$, $p > .01$), but there are some weak links to the attribute scales. People with increased knowledge tend to perceive fewer elements of interference ($r = -.16$; $p < 0.01$) and they also have higher expectations about the decrease of environmental problems by application of wind power, but this relation is very weak ($r = .08$; $p < .01$).

3.3. Landscape, the dominant factor

Obviously, noise is an impact factor that must be treated seriously and adequately, but it is only a secondary factor as far as attitudes are concerned. In an international study at 16 locations in three countries in 1993, when not many people actually lived near turbines, it was found that the relationship between noise annoyance and sound level is not strong [21]. Recent research reinforced this finding in a Swedish survey among residents living near medium-sized turbines (~600 kW). Originally Persson–Waye and Öhrstrom [22] established clear relations between experimental exposure to turbine noise and perceived annoyance. However, Table 3 presents recent results from their research group in field settings with respondents actually living near wind turbines. Based on the findings of [21] they included several attitude scales in their survey, and they found that noise annoyance is more strongly related to visual impact attitudes than to sound pressure [23].

The obvious conclusion of the analysis of co-variance is—visual evaluation of the impact of wind power on the values of the landscape is by far the dominant factor in explaining why some are opposed to wind power implementation and why others support it. Moreover, on the basis of other research on how people judge scenic value, we know that it is the type of landscape in which the turbine is sited that is the most significant factor [24]. This study shows that, even at local level, direct environmental annoyance factors, of which noise is the most prominent one, are dominated by the visual/landscape factor. Furthermore, even at the level of the *general implementation of wind power*—to be distinguished from the attitude towards one particular wind power scheme [25]—the visual/landscape factor, that basically represents location characteristics and the identity of the place, is already dominant. If we examine the situation at local level, we have to consider the behavioural component of attitudes, viz. the intentions to act in one way (oppose a wind power scheme) or another (passively accept it or actively support it). In the study [17] the intention to resist the siting of a wind farm nearby a community was investigated, with the results presented in Fig. 1. The model includes variables together with considerations which are particularly valid for behaviour. For example, the personal political efficacy is a variable that generally refers to feelings relating to the impact of personal actions on political decisions. The scale of fairness, equity and NIMBY will be elaborated in the following sections.

We see that the impact of the visual aspect on the intention to resist (a scale of intended oppositional acts) is even stronger at the local project level. The general attitude is already influenced strongly by the landscape factor, and at the local level there is an additional direct negative impact. Furthermore, some other factors concerning the location, design and characteristics of the project, that do not significantly influence the general attitude,

Table 3
Noise annoyance, explained by sound pressure level (dBA-category) and attitudinal variables

Expl. variable	*b*	
Noise exposure (dBA)	0.57	$p<0.001$
Attitude to visual impact	1.59	$p<0.001$
Sensitivity to noise	0.22	n.s

b: stand. logistic regression coeff.
$N = 351$; pseudo $R^2 = 0.47$ [source: 23].

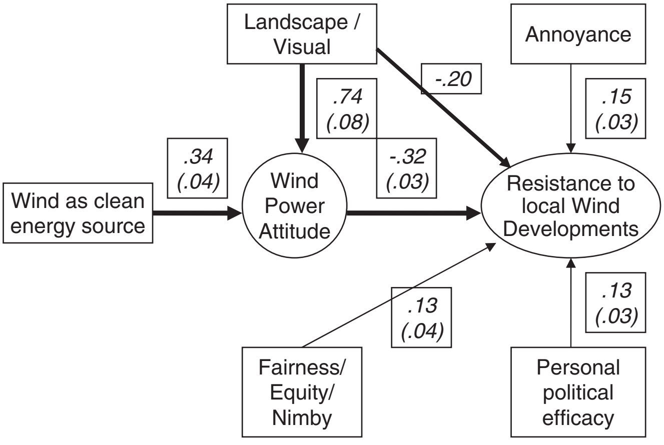


Fig. 1. Direct and indirect impact of arguments and motives on resistance to wind turbine projects. LISREL analysis [26], maximum likelihood estimates. Wind farm sample [17]; $N = 725$. Standardised path coefficients: βs (standard errors). $\psi_{\text{Attitude}} = .28$; $\psi_{\text{Resist}} = .55$; Adj. Goodn. of Fit = .972.

also become important at project level. This concerns the scale of annoyance, including noise, light and flicker, impact on birds and impact on nature. Furthermore, there is no influence of general environmental concerns, nor an acknowledgement of wind as a clean source of energy on intended oppositional behaviour, other than an indirect influence via the general attitude.

The dominance of the characteristics of the landscape on attitudes can easily be illustrated with figures on the huge differences in acceptability of wind turbines in different types of landscapes. Table 4 shows such figures based on a nationwide sample from the members of a national environmental organisation [27]. The Wadden Vereniging is an organization whose aim is to protect the Wadden Sea. About half of the economically feasible wind energy potential in The Netherlands is located in the North and northwestern part of the country. The largest part is situated around the Wadden Sea wetland, an ecologically important area of shallows and small islands extending along the coast of Germany and Denmark. In this survey, the assessment of the degree to which wind turbines would spoil the landscape in the Wadden region was also the strongest reason to oppose further wind turbine developments. Although the shallows are very important to large numbers of birds, this remained a secondary consideration only. The contribution of wind energy to slowing the greenhouse effect was totally insignificant. This indicates that the choice between sustainable energy and ecological values is not really a dilemma for the members. They simply assess the applicability and acceptability of wind turbines in terms of visual intrusion, landscape quality and the consequences for the chosen location. Even from that point of view, most members think there will still be suitable wind turbines sites, even in a sensitive area like the Wadden Sea.

To investigate the most important question for members, viz. which sites are acceptable, the respondents were presented with a list of 19 characteristic landscapes. About half of these options were rejected by a majority, some due to their location in nature reserves, the dunes along the North Sea coast and off-shore in the Wadden Sea (Table 4). Other examples of poor siting were recreational areas and locations near dwelling mounds, which

Table 4
Average scores and factor loadings of acceptability of wind turbines in landscape type within the Wadden Sea region, according to members of the Wadden Vereninging[a]

Landscape type	Mean[b]	Loading on factor	Factor
Industry, harbour areas	2.12	0.529	II
Military areas	2.12	0.569	I
Afsluitdijk	2.33	0.775	I
Waterways, roads, railways	2.47	0.574	I
North Sea	2.55	0.885	IV
Argicultural areas	2.68	0.468	I
North Sea dikes	2.83	0.652	I
New clay polders	3.05	0.663	I
North part IJsselmeer	3.11	0.659	I
Near residential areas	3.44	0.838	III
Lauwersmeer	3.47	0.579	I
Mound landscape	3.60	0.395	II
Wadden Sea Dikes	3.60	−0.804	II
Polders on the islands	3.66	−0.456	II
Recreational areas	3.80	0.676	III
North Sea dunes	4.21	−0.745	II
Wadden Sea	4.22	−0.687	II
Nature areas	4.38	−0.593	II
Dunes on islands	4.42	−0.804	II

[a] $N = 531$.
[b] Five-point scales from (1) fully acceptable, to (5) totally unacceptable.

are important cultural relics. However, some other locations were considered suitable places for wind turbines by about half the members, and some by a clear majority. Obviously, industrial areas and military training grounds, both harshly criticised by the environmentalists, were generally found acceptable for wind turbines. As regards the other locations, the majority of members that do not oppose turbines in the Wadden region tend to view these as suitable sites. They offer many opportunities to generate large quantities of wind-power capacity.

Generally considered fairly acceptable were turbines alongside the 32 km dike separating the Wadden Sea from the IJsselmeer (Afsluitdijk). In 2001, the largest wind power scheme ever in The Netherlands (278 MW) failed, because the government refused to negotiate, primarily with the Wadden Vereniging, and tried to implement the wind farm top–down (Fig. 2). Table 4 reveals that there were good options for a wind farm alongside the Afsluitdijk; however, the government did not communicate about the acceptability of different options, and it proposed a wind farm that for a small part was located in the northern part of the IJsselmeer, whereas the larger part was located in the Wadden Sea. Particularly, the latter part is hardly acceptable for anyone, and the Wadden Vereniging succeeded to generate national political support for its resistance [28].

The variety in acceptability of wind turbines is enormous, as illustrated by the average scores in Table 4. Moreover, the judgments do not simply follow one pattern, according to the attitude towards wind power in the Wadden region. A factor analysis revealed four different factors (Table 4). Factor IV only represents the acceptability of off-shore wind

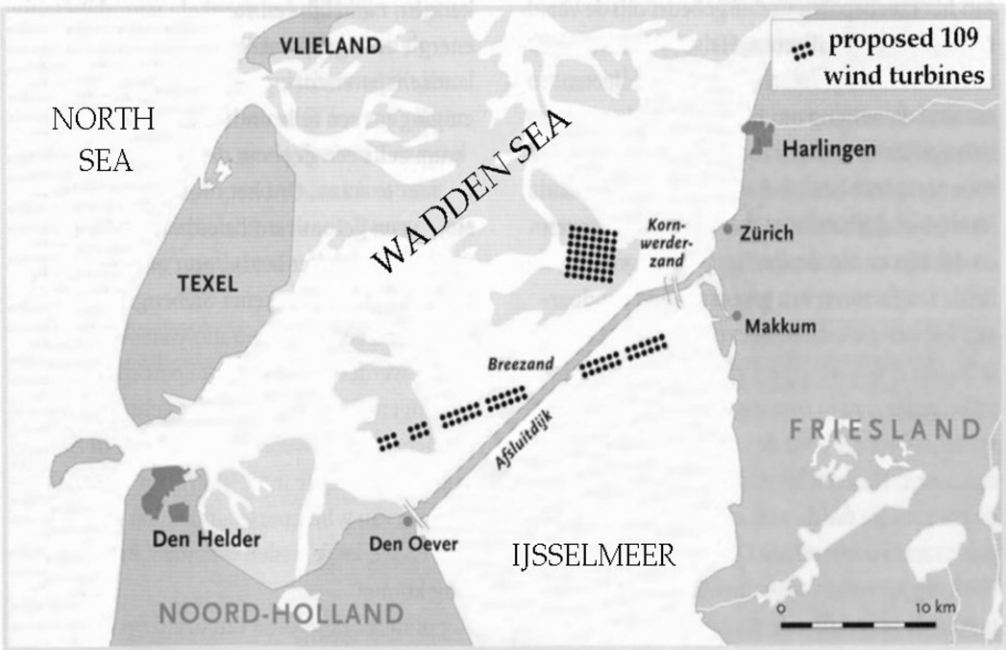


Fig. 2. Western part of the Wadden Sea with the proposed 278 MW wind power scheme. Grey water areas: shallows standing clear of water during low tide.

turbines in the North Sea, and Factor III represents locations near areas used by residents. These two factors are irrelevant for the overall viewpoint on acceptability of wind power in the region. The first two factors, however, did have a significant relation with the overall attitude. Factor I represents mainly the areas that are used for several purposes ($\beta = .43$; $p < .001$), except the areas that clearly represent natural and scenic values. The latter can be found in Factor II ($\beta = .27$; $p < .001$). These two factors explained 44% ($R = .661$; $R^2 = .437$) of the viewpoint on the acceptability of wind turbines in the Wadden region.

4. U-shape development of attitudes

Because attitudes may be dynamic, we need to examine how attitudes are developing along with the development of wind power planning. Several authors have suggested a U-shaped development of attitudes to wind power. These attitudes range from very positive (that is when people are not confronted by a wind power scheme in their neighbourhood), to much more critical (when a project is announced), to positive again (some reasonable time after the construction) [3,16,29]. This U-shape curve is based on the data presented in Table 5, which shows the effects of wind power planning phase factors on the level of the attitude towards wind power, combined with the impact of the second factor of solitary turbines versus wind farm developments. The analysis is based on a set of data collected on 16 occasions, including the samples in Tables 1 and 2.

Table 5
Impact of factors 'planning phase' (solitary turbines vs. wind farms) on level of wind power attitude
Analysis of (co-)variance

Effect	Mean square	d*f*	Sign.
I Phase (no plan–plan–built)	25.0	2	$p<.01$
II Solitary-wind farm	51.6	1	$p<.01$
Interaction effect I and II	0.8	1	n.s.
Covariates[a]	20.5	1	$p<.01$
Within cells	0.93	1725	

[a]Need for control of covariates 'age' and 'political orientation', because of significant correlations with attitude and significant differences between location samples.

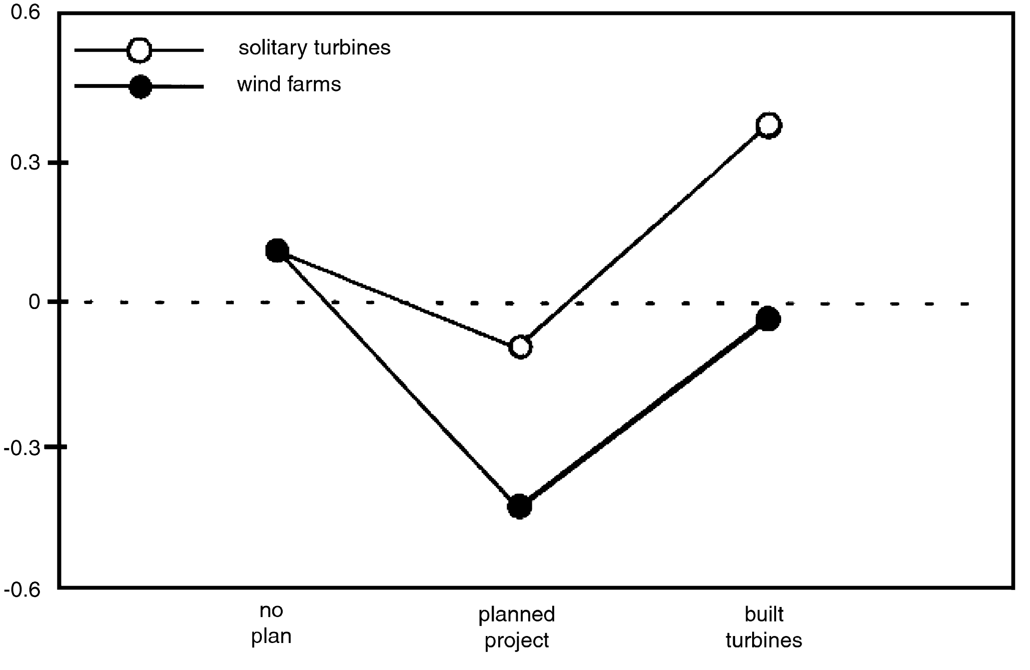


Fig. 3. Development of public attitudes towards wind power, dependent on near-by project [30]. *Note*: Group averages in standard units (z-scores). Overall average is zero, representing a clear majority in favour of large scale application of wind energy.

The effects are shown in Fig. 3, which portrays the U-shaped development of general attitudes if we compare attitudes in different phases of project planning. We can also see the differences due to the type of wind power development. Although there is still a clear majority in favour of the application of wind power in all three phases (attitudes are shown in standard units and the overall average '0' represents the average positive attitude), it is at a minimum when concrete schemes are announced and publicly discussed. The rejection of wind energy, and doubts about the desirability of large-scale application are then most marked in the case of locations with solitary turbines as well as on wind farms locations.

The differences in attitudes are statistically significant, also when we check for relevant variables that indicate differences in the composition of the samples at the locations. It is clear that opinions on a technology alter as soon as people are confronted with an application. Here, we see that the degree to which wind energy is seen as a public good changes over time. The dynamics are accentuated particularly by the fact that attitudes return to a higher level within a year. This latter phenomenon was documented for the first time in a pre–post test control group study around the construction of a solitary 1 MW turbine [7], and it was replicated later and recorded in pre-measurement and post-measurement at a wind farm location [17]. Note that this result underlines the non-static nature of attitudes but, at the same time, it is by no means a guarantee for improvement of attitudes after a facility has been constructed. The effect can only be seen if the existing environmental impact is adequately dealt with, in the eyes of the local population.

5. Misunderstandings of NIMBY

5.1. NIMBY explanation has become outdated

Fig. 3 is very often misunderstood because planners and investors are inclined to look for confirmation of existing beliefs. A very stubborn misunderstanding of this figure is that it indicates the frequently mentioned NIMBY (not-in-my-backyard) character of wind farms. However, it does not indicate NIMBY-ism at all [30]. The idea of NIMBY is rather simplistic as it suggests that people have positive attitudes towards something (wind power) until they are actually confronted with it, and that they then oppose it for selfish reasons [31]. The figure shows that general attitudes become more critical and, on average, less positive. It does not indicate that, despite positive attitudes to wind, people end up acting selfish simply because a wind development has been planned close to where they live. Actually, the combination of general positive attitudes and oppositional behaviour based on selfish motives relating to the 'backyard' idea are rare. The announcement of a project suddenly creates a vested interest and, therefore, it starts a process of thinking. This reconsidering has nothing to do with the distance. In the national survey among the members of the Wadden Vereniging [27] the attitude to the siting of wind turbines in the Wadden region was not in any way related to the distance. The non-existence of a relation with distance to wind power developments was also established in a Swedish study on attitudes to 'green electricity' that generates investment capital for sustainable energy schemes [32].

The idea that resistance to wind power schemes is motivated by selfishness and ignorance is widespread, and even researchers are prone to interpreting critical attitudes to nearby development as NIMBY-ism [3,33–35]. NIMBY thinking among planners and authorities is based on the idea that people only oppose the plans purely because the wind turbines are to be located in their own backyards and pay no regard to the site's other features. If the wind turbines were to be sited elsewhere, the same people would have been in favour and would not have focused on the actual characteristics of the site. This viewpoint is completely unrealistic in its simplicity and, moreover, it is illegitimate because it attributes motives to people that can only be confirmed by investigation. For this reason, social scientific research into wind power implementation tends to reject the NIMBY label, 'because it leaves the cause of opposition unexplained' [36, p. 125].

If we assume opposition is a result of NIMBY, there are six implicit assumptions:

I Decision making as regards wind development tends to be laborious (this usually translates into a call by investors and planners for a speeding-up of the decision making).
II The wind farm represents 'higher' interests than those of the local population.
III Everyone is agreed on the usefulness of wind power developments.
IV No-one wants a wind development facility in his own backyard.

From the third and fourth assumptions, we can logically assume that if we suppose that everyone wants to pass on any inconvenience to someone else.

V Everyone would prefer to have wind development facilities situated in someone else's backyard.
VI The attitudes and opinions which make up the NIMBY phenomenon can be regarded as static. The NIMBY theory does not appear to allow for the possible alteration of insights regarding usefulness and location, something that already has proven to be faulty (Table 5; Fig. 3).

According to the backyard logic, local residents would oppose a project because their aim is to maximise their own individual utility [31]. Because they are in favour of wind power, they will welcome all turbines not built in their vicinity. They minimise the personally perceived impact of wind turbines by blocking the development in their vicinity. According to the social dilemma, if people refuse to co-operate at all locations, wind power will not develop anywhere, and wind will be underused as a source of energy, despite a virtual consensus in favour of it.

Selfish motives are attributed to those harbouring NIMBY sentiments, and their behaviour is viewed as impeding the attainment of societal goals. The outcomes of the NIMBY syndrome are a selfish parochialism that generates locational conflict [37]. The fundamental issue on which the siting problem is based is that of an acceptance by society of policies and technologies. The validity of the NIMBY theory is questionable because the reasoning behind it is faulty. As a matter of fact, the idea that opposition is due to egotist NIMBY-type motives is a factor that has become a great burden to the handling of critical attitudes. This is not something that is limited to wind power, since it affects many other cases of infrastructure development. A point of concern is the imprecise and simplistic way the concept is used by academics and policy makers. This concern is in line with scholars' increasing rejection of the entire NIMBY concept. The literature on the decision making processes concerning infrastructure increasingly criticizes simple NIMBY reasoning [38–43]. What is remarkable about the entire discussion—both in the literature and at policy level—is that most authors using the label are not very specific about what exactly the NIMBY phenomenon is. There is a tendency to label all opposition to spatial developments as NIMBY opposition. If the term 'not-in-my backyard' describes all resistance by communities to the siting of controversial land uses and facilities, it has indeed become just a label lacking in any explanatory value [44]. We therefore need tools to distinguish the inclination towards NIMBY behaviour from other explanations of oppositional behaviour. A good policy theory should acknowledge the complexity of a planning situation rather than simplify it on the basis of questionable assumptions. The

NIMBY scale developed in our research (the impact of an early attempt to measure the NIMBY inclination is visible in Fig. 1) can be used to test the validity of such assumptions.

5.2. Operationalisation of the NIMBY tendency

Opposition can take four forms, and only one fits the definition of the NIMBY syndrome. The following characterization is based on a proposed wind farm, but it is equally valid for other facilities.

I. A positive attitude towards the application of wind power, combined with an intention to oppose the construction of any wind power scheme in one's own neighbourhood (the only true NIMBY-motivated opposition [31]).
II. The not-in-any backyard variant, which means opposition to the application of wind power in the neighbourhood because the technology of wind power as such is rejected. As has been demonstrated, this attitude is based mainly on concerns about landscape values.
III. A positive attitude towards wind farms, which turns into a negative attitude as a result of the discussion surrounding the proposed construction of a wind farm. This is a result of the dynamics shown in Fig. 3).
IV. Resistance created by the fact that some construction plans are themselves faulty, without a rejection of the technology itself.

These attitude patterns can be found in all empirical research on all infrastructure facilities, but often those fundamental differences in the basis for the opposition are not identified as separate causes. All types always exist alongside one another in varying proportions. Presumably this is always the case, although one type may be dominant depending on the nature of the technology and the proposed project. In the case of nuclear facilities, e.g., type II may be dominant, and in a study that empirically established the roots of opposition against a nuclear waste facility in Sweden only 12% could be classified as type I [44]. Where the facility in question is a waste incinerator, III will probably be dominant. After a series of local conflicts about building incinerators and problems of dioxin emissions from incinerators in operation, the result may be an outright aversion to waste incineration, making type II-resistance dominant. Because the majority of the public are in favour of wind power, also on locations with proposed wind farms, resistance to proposed wind turbines is mainly of types III and IV. The most intriguing type, nevertheless, continues to be type I because of its popularity among planners and investors, who prefer it as their explanation of 'the gap' between support for wind power and oppositional behaviour against concrete wind power schemes [25].

5.3. Fairness in decision making

Fig. 1 presents an initial attempt to measure the NIMBY inclination . It shows the limited impact of a five-items scale on the intention to resist the wind farm in the neighbourhood. The impact is statistically significant, but very small compared to other relations. This scale for measuring the NIMBY inclination was further developed and improved, but this time it was applied in large-scale research concerning the decision making in six cases of waste infrastructure [45,46]. The quality of that measurement is presented in Table 6. Six items in

Table 6
Scale analyses for the items indicating the NIMBY inclination in six cases of waste facilities

	Mean
Because others would not accept it either.	2.89
I do not feel like shouldering the burden of a problem that is also caused by others.	2.68
I do not consider it fair (equity/fairness item)	2.44
It is quite stupid to accept it.	2.35
I do not reject it in advance, after all it has to be built somewhere (reversed score)	2.31
If good arguments can be found for my neighbourhood, I will accept (reversed score)	2.26
It is in conflict with my ideas about equality (eq./fairness item)	2.11
Site it in someone else's vicinity.	1.95

Cronbach's $\alpha = .86$.
$N = 1525$; item scale runs from 1 (fully disagree) to 5 (fully agree).

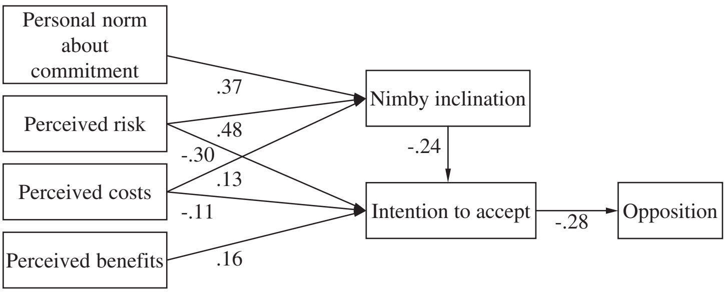


Fig. 4. LISREL analysis of explanation of opposition to waste facilities on six locations. Adj. Goodn. of fit = .934; $n = 1511$; sample data [47]).

the scale were included which were based on pilot study results in which items formulated as indicators for type I behaviour were tested.

The items were formulated as typical NIMBY indicators, reflecting the parochialism that advocates of the term usually assume [47]. In the survey, many other relevant scales were developed, e.g. perceived environmental risk due to incineration, land-filling and fermentation of waste, other perceived costs and benefits and intentions to oppose. Following Kerr [48] we included items to measure the *personal norms about commitment* (to others) and the *personal norms about equity*. The latter appeared to be indicators of the same latent track as the NIMBY items. These two items were added to the questionnaire in an effort to measure the personal norm about equity in social dilemma situations—"It (= siting the facility here) is in conflict with my ideas about equity" and "I do not consider it fair" could not be distinguished from the items measuring the NIMBY inclination. Obviously, the norms for equity and fairness are at stake when local residents develop an inclination to resist unwanted activities in their neighbourhood.

The relation between facility siting issues and environmental injustice is apparently recognized by the residents [49] (Fig. 4). This has been established more often in decisions on quite different facilities, with dilemmas between infrastructure and sustainability such as housing, water management and mineral extraction [50,51]. The personal norm of equity prescribes that the input and the output in the social dilemma should be balanced.

The two items match very well with the normative aspect (as measured with the NIMBY items) in the social dilemma. The reliability of the scale has been improved by including these items in the scale and it must be considered very reliable (Cronbach's $\alpha = .86$).

This research demonstrates that it is possible to construct a reliable scale to measure the NIMBY inclination. This is a useful concept, as it can be used to gain an understanding of the reactions of local residents in the various phases of a decision making process. Furthermore, the analysis stresses that local opposition cannot be explained by the egotistical motives of local residents. The model shows that there is a complex relationship between the inclinations to behave in a NIMBY fashion and perceived negative consequences. This study also established the strong impact of the phase of the decision making process, because normative evaluations are influential in the planning phase, in particular. Nevertheless, the NIMBY inclination is measured using a very reliable scale in which *commitment to equity* becomes clearly manifest. Obviously, the crucial factor is not that residents have strong intentions to shift the burden to others, but that they consider it unfair that others, or the decision makers, shift the burden to them. This suggests that the crucial factor in NIMBY issues is not egotism, nor any other personality trait, but fair decision making that does not cause any perceived injustice. The perceptions of fairness in decision making about siting facilities such as waste incinerators or wind farms, are strongly connected with perceived environmental risk, and also with strongly deviating core values about how society should take such decisions, not only within the public, but among all stakeholders involved in such processes [46]. This is in fact a crucial aspect of infrastructure decision making, including renewable energy infrastructure such as wind power developments. Biomass and bioenergy are already facing such problems. [12].

In the Dutch situation, the planning system does not support the type of decision making that is needed [52]. Because public acceptance for wind energy is high, siting policy is usually not considered as the major problem, and this neglect is not only a Dutch phenomenon [53,54]. The basic idea in Dutch physical planning is prescriptive zoning in municipal zoning schemes with a legally binding effect. Construction and building permits have to be granted when a project proposal fits in with an approved zoning scheme. Existing schemes seldom contain zoning for wind turbines, so they have to be altered. New zoning schemes have to be designed and politically accepted before building permits can be issued. This is a time-consuming process that is absolutely necessary, as building permits may not be issued otherwise. Nevertheless, the procedure itself is not the issue, as over 90% of all permits are issued in all cases in which formal planning procedures are started [55].

6. Conclusion and discussion

The application of wind energy is governmental policy and changing a zoning schemes is a local political decision in most countries (one notable exception—Spain [56,57]). At central government level there is a growing top–down, technocratic, hierarchical way of thinking about how the planning system must be shaped. This view on the practice of planning is, however, mainly a myth because, although central authorities have legal competence for instructing local authorities about specific parts of their zoning schemes, these powers are hardly ever used in practice. Moreover, it is very unlikely that they will ever be used for the siting of wind farms. For large-scale developments, such as railway lines, roads and waste incinerators, the competence of the central authorities in the hierarchy was strengthened recently, and further hierarchical planning has been proposed

[52]. Wind power development would require numerous top–down instructions, and these kinds of interventions contradict the principles of physical planning and legal protection of civilians. The research on attitude development and decision making on the six waste facilities has proven the ineffectiveness of hierarchical planning compared to collaborative approaches [45,46]. In general, but certainly in The Netherlands, the following is fundamental to wind power development:

'The success of wind power depends on how well the wind industry learns to include the public in decisions, both for the opportunities this allows for broader dissemination of information about wind power and for the suggestions the public can contribute to the discussion of their concerns and how to accommodate them' [29, p. 169].

Comparing countries with a poor performance as regards the implementation of wind power (e.g. the UK, The Netherlands) with successful countries (Denmark, Germany) reveals obvious differences such as the way in which projects are developed and decisions taken as regards locations [56]. Moreover, these decisions are actually taken at local level, whereas real options for locals to become involved in investing in the wind projects may generate positive effects for success [45,58]. The best way to facilitate the development of appropriate wind farms is to build institutional capital (knowledge resources, relational resources and the capacity for mobilisation) through collaborative approaches to planning. Policy actors and wind power developers should focus on building up institutional capital for wind power and other renewable resources, instead of complaining about public attitudes. This need for a collaborative approach in making wind power implementation effective is now internationally recognised by researchers investigating the implementation process. Bad communication can always lead to problems, but the key question is always *why* there is bad communication. It is mostly caused by the way decision making is framed, e.g. by limiting the options for public participation to only consultation after the design and announcement of a project [45,46,59]. As regards wind power implementation, neither specific nor 'top–down' imposed decision making is likely to be as effective as a collaborative approach. It is a perfect example of the need for open-ness in the process and the avoidance of technocratic and corporatist based elite decision making. It is not simply clean technology that only has to be implemented, and institutional changes are always needed in the process of ecological modernization [60]. If they are not, the implementation process will stagnate. However, the question is why the planning systems so often impede these principles. In the case of wind power, the system that is framing the way decisions are taken is that of spatial planning and the energy policy domain [1,4]. The impact of such framing conditions is largely underestimated in policy, and it is mostly not even recognized. The simplified views, e.g. on impediments for wind power implementation caused by spatial planning processes are mostly based on false notions of the nature and the impact of public attitudes. The impact of public attitudes on success or failure of wind power implementation is usually overestimated. At the same time, the valuable information that comes from well-executed, theory-based survey research is largely not recognized and interpreted with strong bias.

These notions are in line with the idea that participatory processes are crucial to wind power implementation, but in practice the spatial planning system in some countries, for example in The Netherlands [52] or Sweden [11,59], does not encourage collaborative planning processes or community involvement in wind power developments. Decision making on renewable power facilities does not usually include the most important discussion point for public stakeholders, which in the case of wind farms is the choice of

the location. Theoretically, several different sites should be developed before a choice is made, but this almost never happens. A location is selected beforehand and top–down planning is then started. Consultation after a plan has been announced is more of a trigger for opposition than an incentive for the proper design of acceptable projects. The 'public hostility' that sometimes emerges is mostly triggered by those top–down processes.

Acknowledgements

This paper has been written based on a presentation at the International Energy Agency's 42nd IEA Topical Expert Meeting, Stockholm, 16–17 March 2004. The author likes to thank the workshop's participants for useful comments.

References

[1] Wolsink M. Dutch wind power policy. Stagnating implementation of renewables. Energy Policy 1996;24:1079–88.
[2] Van der Horst D. UK biomass energy since 1990: the mismatch between project types and policy objectives. Energy Policy 2005;33:705–16.
[3] Gipe P. Wind energy comes of age. New York: Wiley; 1995.
[4] Breukers S, Wolsink M. Institutional capacity in policy processes for wind energy in the Netherlands. Environ Politics 2006 submitted for publication.
[5] Enzensberger N, Wietschel M, Rentz O. Policy instruments fostering wind energy projects. A multi-perspective evaluation approach. Energy Policy 2002;30:793–801.
[6] Thayer RL, Freeman C. Public perceptions of a wind energy landscape. Landscape Urban Plan 1987;14:379–98.
[7] Wolsink M. The social impact of a large wind turbine. Environ Impact Assess Rev 1988;8:323–35.
[8] Wolsink M. Attitudes and expectancies about wind turbines and wind farms. Wind Eng 1989;13:196–206.
[9] Walker G. Renewable energy and the public. Land Use Policy 1995;12:49–59.
[10] Kaldellis JK, Kavadias KA. Evaluation of Greek wind parks visual impact. "The public attitude". Fresenius Environ Bull 2004;13:413–23.
[11] Söderholm P, Ek K, Petterson M. Wind power development in Sweden: global policies and local obstacles. Renew Sustain Energy Rev 2006;10 in press.
[12] Upreti BR, Van der Horst D. National renewable energy policy and local opposition in the UK; the failed development of a biomass electricity plant. Biomass Bioenergy 2004;26:60–9.
[13] Kahn J. Local politics of renewable energy. Project planning, siting conficts and citizen participation. PhD thesis, Lund University, 2004.
[14] Wolsink M. The planning system and its impact on sustainable urban form and energy demand. In: ECEEE summer study "Time to turn down energy demand", vol. 2. Stockholm: ECEEE; 2003. p. 574.
[15] Elliott D. Renewable energy and sustainable futures. Futures 2000;32:261–74.
[16] Devine-Wright P. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. Wind Energy 2005;8:125–39.
[17] Wolsink M. Maatschappelijke acceptatie van windenergie. Amsterdam:Thesis Publishers;1990.
[18] Woods M. Conflicting environmental visions of the rural: windfarm development in mid Wales. Sociol Ruralis 2003;43:271–88.
[19] Brittan GG. Wind, energy, landscape: reconciling nature and technology. Philos Geogr 2001;4:169–84.
[20] Bang HK, Ellinger AE, Hadjimarcou J, Traichal PA. Consumer concern, knowledge, belief, and attitudes toward renewable energy: an application of the reasoned action theory. Psychol Market 2000;17:449–68.
[21] Wolsink M, Sprengers M. Windturbine noise: a new environmental threat? In: Vallet M, editor. Noise as a public health problem, vol. 2. Bron (F): INRETS; 1993. p. 235–8.
[22] Persson-Waye K, Öhrström E. Psycho-acoustical characters of relevance for annoyance of wind turbine noise. J Sound Vib 2002;250:65–71.
[23] Pedersen E, Persson-Waye K. Perception and annoyance due to wind turbine noise—a dose–response relationship. J Accoust Soc Am 2005;116:3460–70.

[24] Wolsink M, Van de Wardt JW. Visual impact assessment; a review of recent research. In: European wind energy conference Glasgow (Part I). London: Peter Peregrinus; 1989. p. 471–5.
[25] Bell D, Gray T, Haggett C. The 'social' gap in wind farm siting decisions: explanations and policy responses. Environ Politics 2005;14:460–77.
[26] Jöreskog KG, Sörbom D. LISREL 8: structural equation modeling with the SIMPLIS command language. Scientific Software Int.; 1993.
[27] Wolsink M. Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. Renew Energy 2000;21:49–64.
[28] Wolsink M, Breukers S. Waddenzee, Afsluitdijk en windcentrale. Rooilijn 2002;35:212–7.
[29] Pasqualetti MJ. Living with wind power in a hostile landscape. In: Pasqualetti MJ, Gipe P, Righter RW, editors. Wind power in view. Energy landscapes in a crowded world. San Diego: Academic Press; 2002. p. 153–72.
[30] Wolsink M. Entanglement of interests and motives. Assumptions behind the nimby-theory on facility siting. Urban Stud 1994;31:851–66.
[31] O'Hare M. "Not on MY block you don't": facility siting and the strategic importance of compensation. Public Policy 1977;25:407–58.
[32] Ek K. Public and private attitudes towards "green" electricity: the case of Swedish wind power. Energy Policy 2005;33:1677–89.
[33] Kaldellis JK. Social attitude towards wind energy applications in Greece. Energy Policy 2005;33:595–602.
[34] Maillebouis C. Nimby ou la colère des lieux. Le cas des parcs éoliens. Nat Sci Soc 2003;11:190–4.
[35] Kahn ED. Siting struggles: the unique challenge of permitting renewable energy power plants. Electr J 2000;13:21–33.
[36] Kempton W, Firestone J, Lilley J, Rouleau T, Whitaker P. The off-shore wind power debate. Views from Cape Cod. Coastal Manage 2003;33:119–49.
[37] Inhaber H. Slaying the nimby dragon. New Brunswick: Transaction Publishers; 1998.
[38] Freudenburg WR, Pastor SK. NIMBYS and LULUS: stalking the syndromes. J Social Iss 1992;48:39–61.
[39] Lake RW. Rethinking NIMBY. J Am Plan Assoc 1993;59:87–93.
[40] Luloff AE, Albrecht SL, Bourke S. Nimby and the hazardous and toxic waste siting dilemma: the need for concept clarification. Soc Nat Res 1998;11:81–9.
[41] McAvoy GE. Controlling technocracy. Citizen rationality and the nimby syndrome. Washington, DC: Georgetown University Press; 1999.
[42] Burningham K. Using the language of NIMBY: a topic for research, not an activity for researchers. Local Environ 2000;5:55–67.
[43] Thornton B, Knox D. "Not in my back yard": the situational and personality determinants of oppositional behavior. J Appl Soc Psychol 2002;32:2554–74.
[44] Sjöberg L, Drottz-Sjöberg B. Fairness, risk and risk tolerance in the siting of a nuclear waste repository. J Risk Res 2001;4:75–101.
[45] Van Baren NGE. Planhiërarchische oplossingen: een bron voor maatschappelijk verzet. PhD thesis, Universty of Amsterdam; 2001.
[46] Wolsink M. Policy beliefs in spatial decisions: contrasting core beliefs concerning space making for waste infrastructure. Urban Stud 2004;41:2669–90.
[47] Devilee JLA. Decision-making about waste facilities. PhD thesis, University of Amsterdam, 2002.
[48] Kerr NL. Norms in social dilemmas. In: Schroeder DA, editor. Social dilemmas: perspectives on individuals and groups. Westport: Praeger; 1995. p. 31–47.
[49] Capek SM. The environmental justice frame. A conceptual discussion and application. Social Problems 1993;40:5–24.
[50] Wolsink M. River basin approach and integrated water management: governance pitfalls for the Dutch space–water-adjustment management principle. Geoforum 2006;37 in press.
[51] Cowell R, Owens S. Suitable locations: equity and sustainability in the minerals planning process. Regional Stud 1998;32:797–811.
[52] Wolsink M. Reshaping the Dutch planning system: a learning process? Environ Plan A 2003;35:705–23.
[53] Toke D. Explaining wind power planning outcomes: some findings from a study in England and Wales. Energy Policy 2005;33:1527–39.
[54] Lyrette É, Trépanier M. Les dynamiques sociales engenders par l'implantation du parc éolien le Nordais. VertigO—La rev en sci de l'environ 2004;5:1–9.

[55] Koeslag J. Vergunningtraject van windenergie; een onderzoek naar de doorlooptijd en de slagingskans van de juridische procedures voor het plaatsen van windturbines. Rotterdam: CEA; 2002.
[56] Toke D, Wolsink M, Breukers SC. Comparing wind power planning outcomes in different countries—how can we account for the differences? Environ Plan C 2006 submitted for publication.
[57] Faulin J, Lera F, Pintor JM, García J. The outlook of renewable energy in Navarre: an economic profile. Energy Policy 2006 in press.
[58] Bolinger MA. Making European-style community wind power development work in the US. Renew Sustain Energy Rev 2005;8:556–75.
[59] Hammarlund K. Society and wind power in Sweden. In: Pasqualetti MJ, Gipe P, Righter RW, editors. San Diego: Academic Press; 2002. p. 101–14.
[60] Gibbs D, Jonas AEG. Governance and regulation in local environmental policy: the utility of a regime approach. Geoforum 2000;31:299–313.